Headquarters U. S. Air Force

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Operational Based AF Maintenance Standards

U.S. AIR FORCE

Lt Col Christopher Burke
Weapons Systems Division
Directorate of Maintenance

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Overview

- CSAF Quarterly Health of the Fleet Review
- Maintenance Standards
  - Mission Capability (MC)
  - Total Not Mission Capable for Maintenance (TNMCM)
  - Total Not Mission Capable for Supply (TNMCS)
- Aircraft Availability Targets
- MERLIN (Multi-Echelon Resource and Logistics Informational Network)

AF Aggregate Fleet Rates

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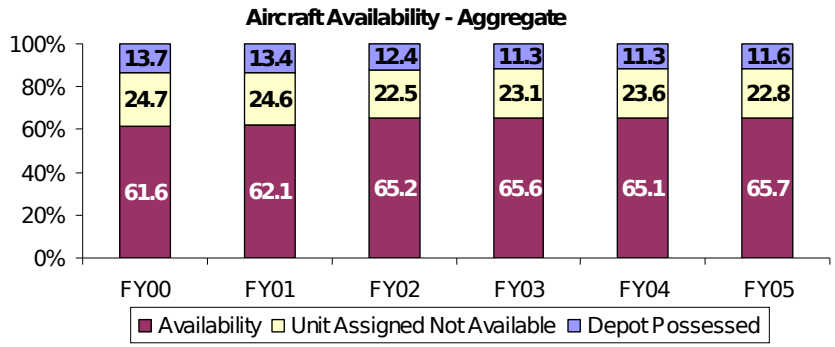

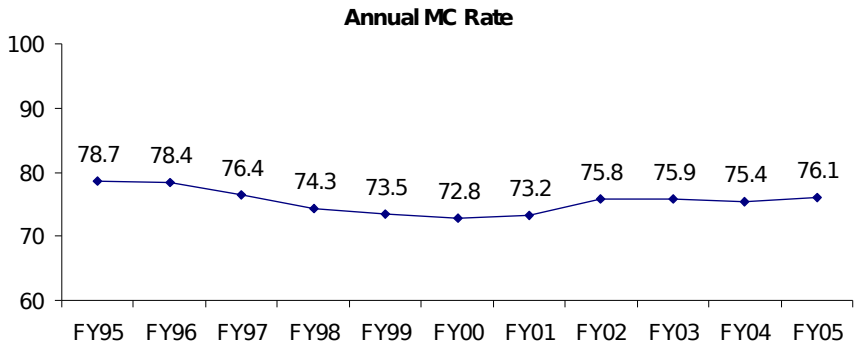

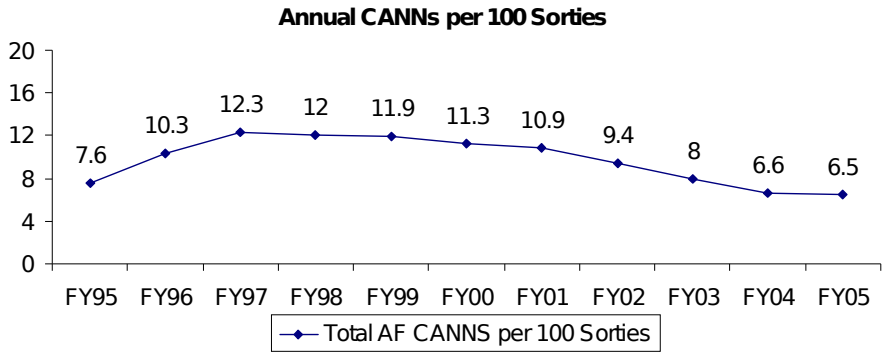

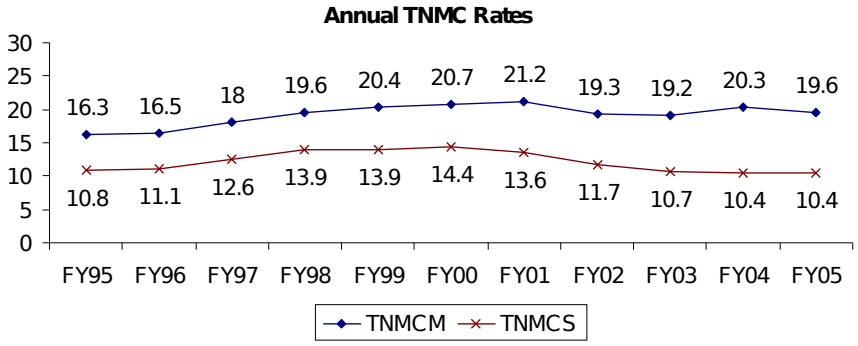

SOURCES: REMIS and MERLIN

As of: 31 Oct 04

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Background

- **BACKGROUND**
  - **At CORONA 03, CSAF directed establishment of AF standards for MC/TNMCS/TNMCM (OPR = IL)**
- **ASSUMPTIONS…AF standards must be…**
  - **Operationally/resource based**
- **OUR CHARTER**
  - **Develop AF standards rooted in *operational requirements* and *resources* dedicated to the weapon system/MDS**

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Maintenance Standards Methodology

Ops-based/resource-driven

- **Methods used for MC Rate Standard**
  - **In-garrison flying hour program (FHP)**
    - **UTE, Attrition, Spares, Turn Pattern, Fly Days**
    - **Used weighted factors**
  - **Validated ORD or Mobility Requirements Study**
- **TNMCS Rate Standard = (1 - Aircraft Availability Target) or CLS Goal**
  - **Ties TNMCS standard to spares funding/requirements**
  - **Used FY03 AATs – so parts will be on the shelf in FY05**
- **TNMCM Rate Standard**
  - **TNMCM = 100 – (MC Std + TNMCS Std) + 3 Year Historical NMCB**

MC Standard Formula

$$\text{MC Std} = \frac{\text{Sortie}}{\dfrac{12 \times \text{UTE}}{(1-\text{Attrition}) \times (\text{Turn Pattern}) \times (\text{Fly Days})}} + \frac{\text{Other}}{\dfrac{\text{Spares + Mx Req'd}}{\text{Squadron PAI}}} \text{ MC}$$

WHERE

12 x UTE yields annual sorties required to meet FHP

Dividing by (1-Attrition) yields the sorties required to be scheduled to account for attrition

Dividing by the turn pattern yields the number of front-line flyers

Dividing by the number of fly days yields the number of front-line flyers per day

And spares/MC aircraft required for maintenance are expressed

Example F-16C/D MC Standard

MC STD = (UTE x 12)/((1-Attrition Rate) x (Turn Pattern x Fly Days)) + (Front Line Spares + MC for Sched Mx)/Unit PAI

UTE	18
Attrition	15.0%
Turn Pattern	1.76
Fly Days	232
Front-Line Spares	2.4
MC for Sched Mx	2
MC (Req)	81%

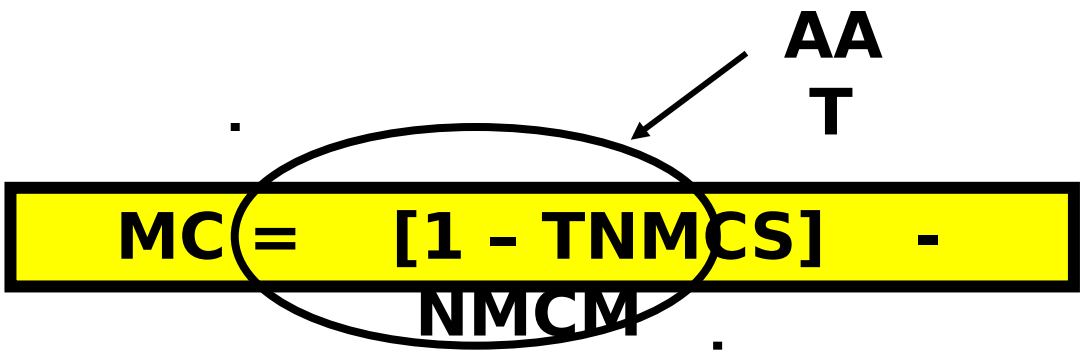
$$\text{MC Std} = \frac{12 \times 18}{(1-.15) \times (1.76) \times (232)} + \frac{2.4 + 2}{24}$$

TNMCS STD = (1 – AAT) = (1 – 90) = 10%

TNMCM = 100 – (MC Std + TNMCS Std) + 3 Year Historical NMCB = 100 – (81 + 10) + 6 = 15%

Aircraft Availability Target (AAT) Defined

- AAT is a component of the MC target
  - Used to compute spares to achieve weapon system MC goals
  - "Sizes" the buy portion of the safety level
- Assumes pipeline and safety levels have been fully funded
  - Implies we can only achieve AAT if……..



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AAT Equation

$1 - TNMCS = MC_{(REQ)} + NMCM$

AA TARGET

WT_{WINLAM} or PT

3yr NMCM

More Stringent MC_{REQ}

~~AAT = MC~~

Law of Diminishing Returns

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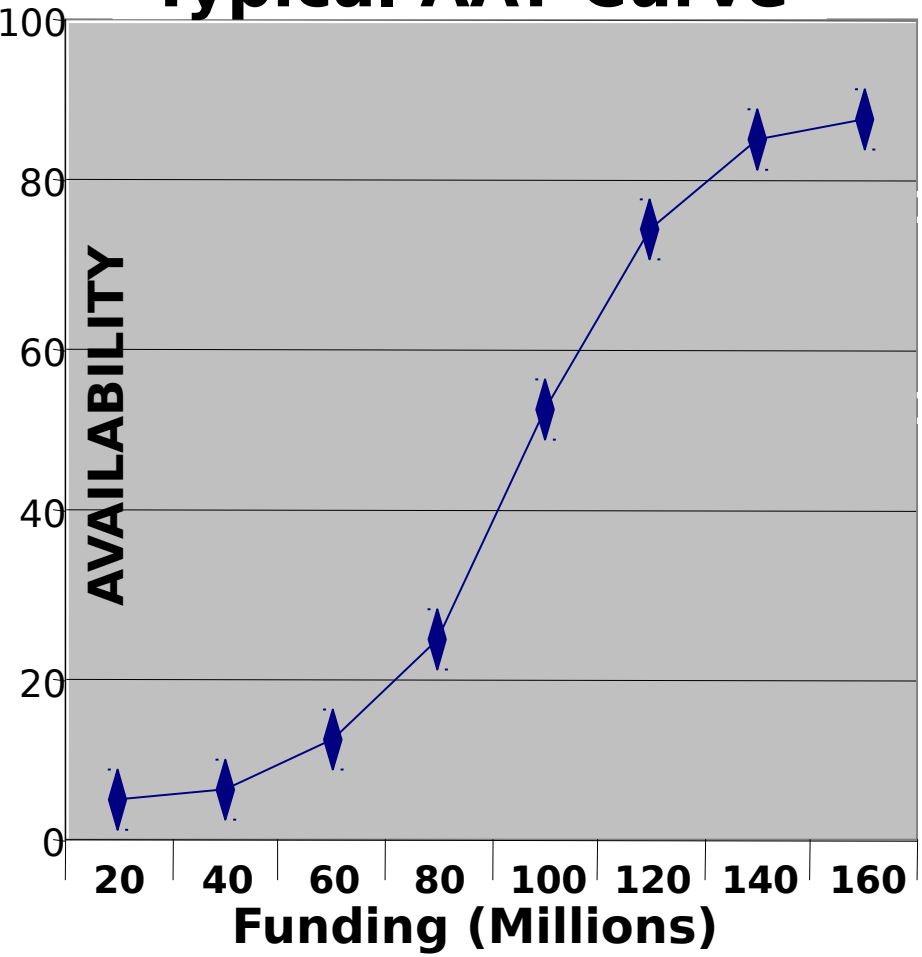
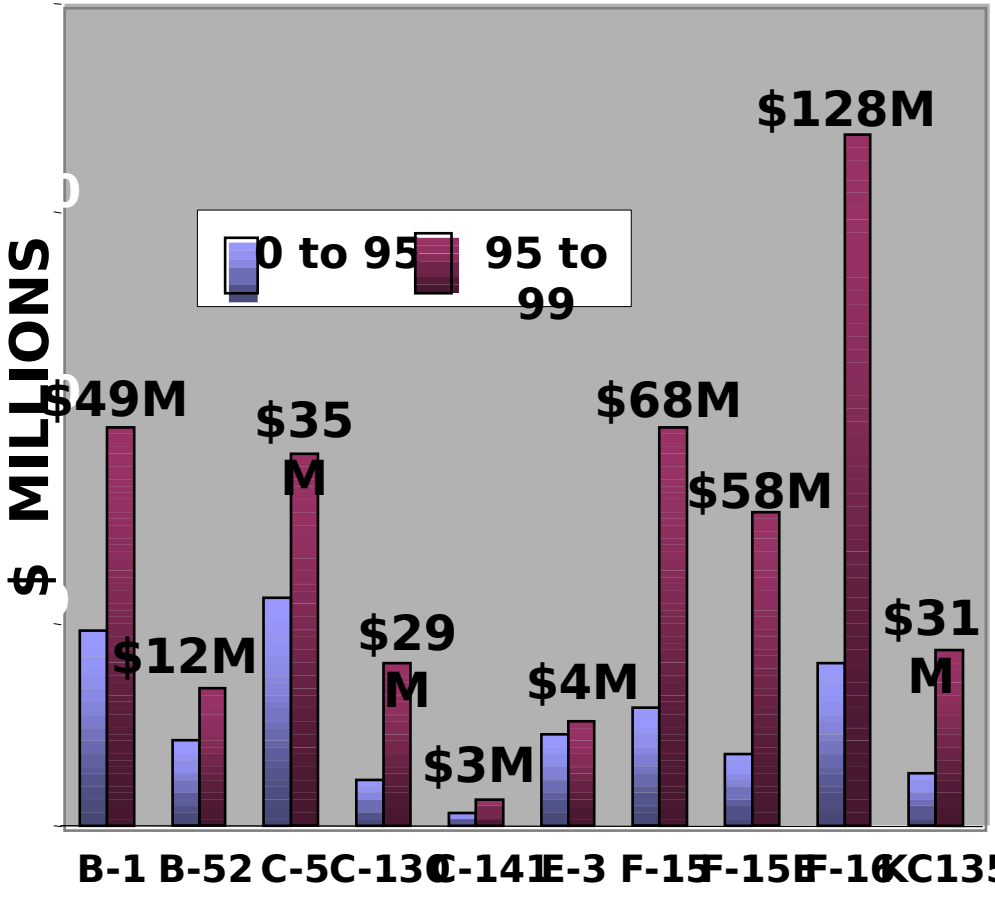
Typical AAT Curve



Cost for 95% to 99% AAT



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Multi-Echelon Resource and Logistics Information Network

MERLIN

merlin WHATS NEW!

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MERLIN Overview

- **Why was MERLIN created?**
  - **Inconsistencies in logistics data reporting**
  - **Objective: Standardized and automated AF metrics**
- **What does it do?**
  - **Compiles data from multiple AF legacy/modernized databases**
  - **Provides one-stop shopping for AF action officers**
  - **Standardized logistics metrics reports**
  - **Very responsive to short-notice studies and analyses**
  - **Primary source for monthly CSAF aircraft trend analysis**

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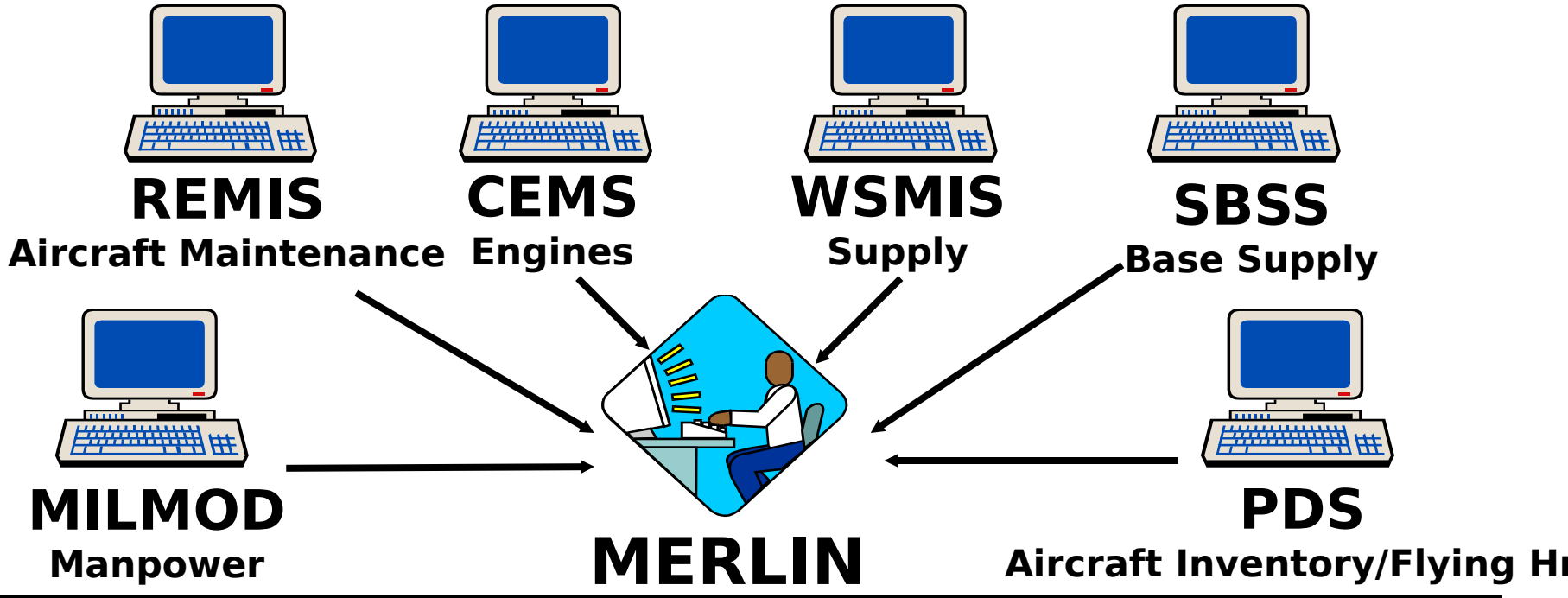
MERLIN Data Sources



PDS: Program Data System **MILMOD: Military Modernization**

REMIS: Reliability& Maintainability Information System

CEMS: Comprehensive Engine Management System

SBSS: Standard Base Supply System

WSMIS: Weapons System Management Information System

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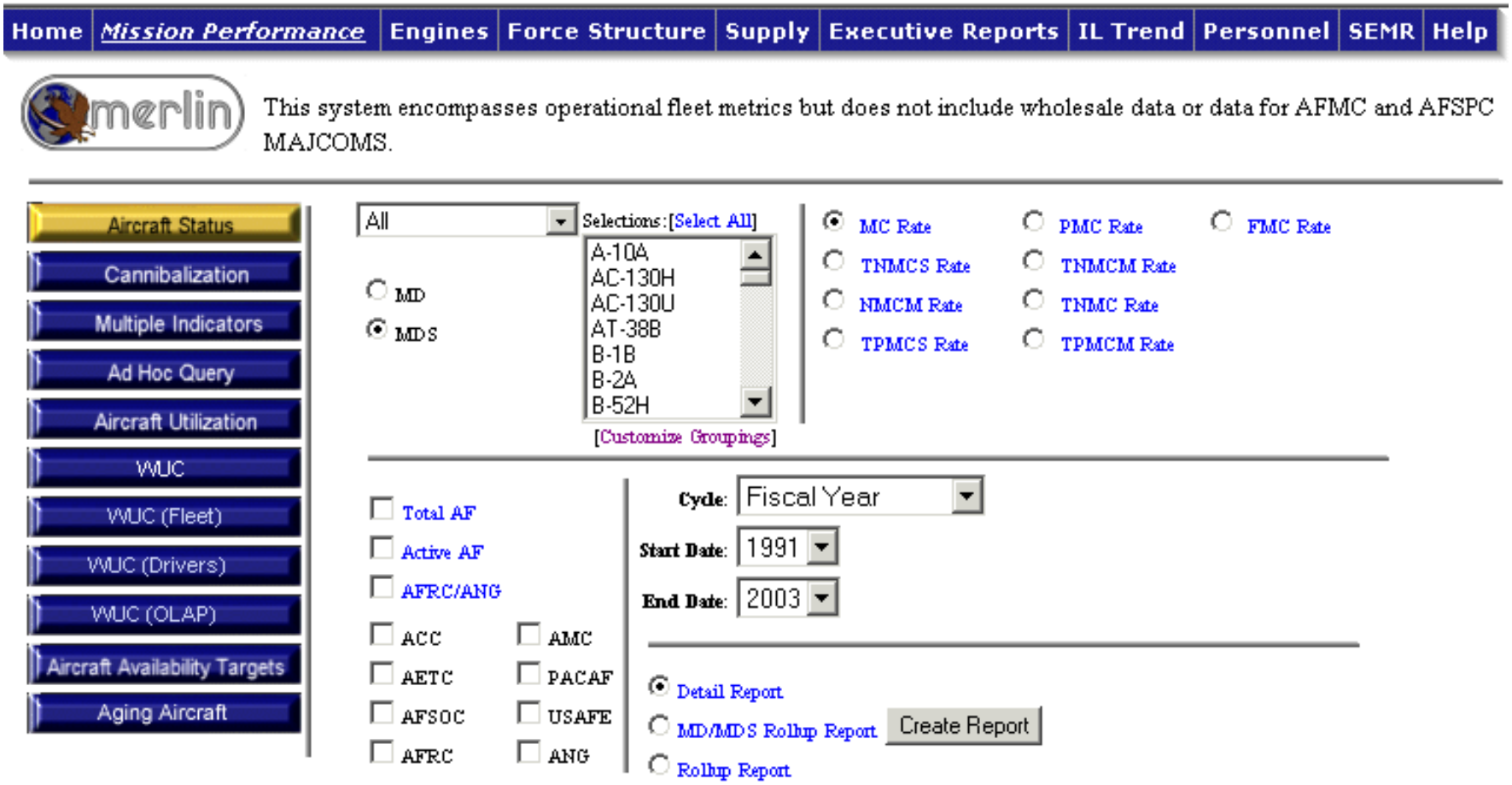
MERLIN Aircraft Page



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Questions

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Backups

Aircraft Availability Metric

Definition:

Percentage of a fleet not in a Depot possessed status or NMC aircraft (that are unit possessed)

Computation:

$$\text{Availability} = \frac{\text{MC hours}}{\text{Total Possessed hours}} \times 100$$

FY05 Air Force Standards

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Green = Less Restrictive Orange = More Restrictive Blue = Contractual Rate		MC			TNMCM			TNMCS		
		FY05 Std	FY04 Std	FY04 Actual	FY05 Std	FY04 Std	FY04 Actual	FY05 Std	FY04 Std	FY04 Actual
A/OA-10A	Active	81	80	75.3	17	16	18.3	8	8	11.0
	ANG/AFR	71		68.4	29		28.9	8		13.2
F-15A/B	ANG/AFR	73	77	73.1	27	23	24.2	8	8	10.8
F-15C/D	Active	81	82	79.4	14	15	15.6	8	8	8.0
	ANG/AFR	75		75.9	25		20.6	8		12.6
F-15E	Active	80	80	79.2	14	14	14.7	10	10	9.1
F-16A/B	ANG/AFR	70	75	71.5	28	19	27.1	10	10	8.8
F-16C/D	Active	82	81	82.4	11	13	12.2	10	10	8.0
	ANG/AFR	72		68.6	28		27.8	10	10	14.3
F-117A	Active	77	80	73.9	21	16	23.3	5	5	6.6
B-1B	Active	70	76	68.8	26	22	22.5	8	8	12.2
B-2A	Active	51	51	44.8	49	33	34.8	6	6	4.9

FY05 Air Force Standards

Green = Less Restrictive Orange = More Restrictive Blue = Contractual Rate		MC			TNMCM			TNMCS		
		FY05 Std	FY04 Std	FY04 Actual	FY05 Std	FY04 Std	FY04 Actual	FY05 Std	FY04 Std	FY04 Actual
C-5	Active	75	75	66.6	23	24	27.5	8	8	12.6
	ANG/AFR	55		51.2	42		40.7	8		22.8
C-17A	Active	87.5	87.5	84.9	9.4	9.4	12.6	7	7	4.2
	ANG/AFR	87.5		88.7	9.4		10.9	7		4.5
C-130E/H	Active	75	75	78.5	21	16	18.2	9	9	7.8
C-130E	ANG/AFR	69		66.6	31		30.6	9		16.2
C-130H	ANG/AFR	72		72.8	28		24.6	9		12.2
C-130J	ANG/AFR	75		75.0	25		20.3	9		14.3
KC-10A	Active	85	85	82.3	12	13	11.2	5	5	4.7
KC-135R/T	Active	84	84	84.1	12	13	11.2	8	8	7.2
KC-135D/E	ANG/AFR	68		71.5	31		26.8	8		8.6

FY05 Air Force Standards

Green = Less Restrictive Orange = More Restrictive Blue = Contractual Rate		MC			TNMCM			TNMCS		
		FY05 Std	FY04 Std	FY04 Actual	FY05 Std	FY04 Std	FY04 Actual	FY05 Std	FY04 Std	FY04 Actual
E-3B/C	Active	79	80	79.9	17	18	17.9	7	7	3.8
E-4B	Active	77	74	77.0	15	19	17.8	15	15	13.6
E-8	ANG/AFR	78	79	76.7	19	20	18.3	7	7	9.1
EC-130E	ANG/AFR	74	74	61.4	26	25	37.8	9	9	11.5
EC-130J	ANG/AFR	74	74	67.6	26	25	25.7	9	9	15.1
EC-130H	Active	76	77	71.3	21	16	22.4	9	9	12.7
HC-130N/P	Active	78	74	68.7	20	19	24.3	10	9	15.5
	ANG/AFR	71		56.3	29		42.4	10		17.7
HH-60G	Active	76	74	67.4	20	17	23.2	10	10	18.2
	ANG/AFR	65		50.2	35		45.1	10		22.9
LC-130H	ANG/AFR	70	74	51.2	30	26	43.9	9	9	22.5
RC-135	Active	74	74	76.2	18	22	18.3	14	14	12.2
HH-1N		80	80	80.4	16	19	15.9	10	13	10.7

FY05 Air Force Standards

Green = Less Restrictive Orange = More Restrictive Blue = Contractual Rate		MC			TNMCM			TNMCS		
		FY05 Std	FY04 Std	FY04 Actual	FY05 Std	FY04 Std	FY04 Actual	FY05 Std	FY04 Std	FY04 Actual
AC-130H	Active	82	82	70.7	11	18	24.1	10	9	8.5
AC-130U	Active	85	85	84.1	8	14	13.0	10	9	5.1
MC-130E	ANG/AFR	76	76	75.3	21	16	21.7	10	9	12.0
MC-130H	Active	84	84	78.5	13	20	19.3	10	9	9.2
MC-130P	Active	78	78	70.4	18	19	23.8	10	9	12.5
	ANG/AFR	70		52.6	28		42.5	10		5.7
MH-53J/M	Active	78	75	69.5	19	16	23.0	10	10	14.1
T-1A	Active	82	82	84.6	15	15	14.8	3	3	.7
T-6A	Active	91	91	88.0	10	10	8.8	4	4	3.6
T-37B	Active	80	80	87.6	14	14	11.4	10	10	2.0
T-38A/C	Active	75	75	79.2	19	19	17.7	9	9	6.3
T-43A	Active	80	80	87.6	20	20	11.2	5	5	2.2

MERLIN: Multi-Echelon Resource and Logistics Information Network

- **Data Available**
  - **FMC**
  - **MC**
  - **TPMCM**
  - **TPMCS**
  - **PMCM**
  - **PMCS**
  - **PMCB**
  - **TNMCM**
  - **TNMCS**
  - **NMCM**
  - **NMCS**
  - **NMCB**

Generating the Availability Curve

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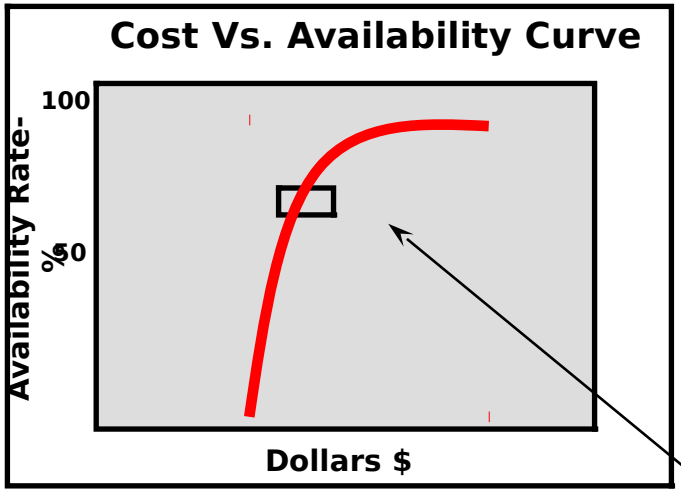
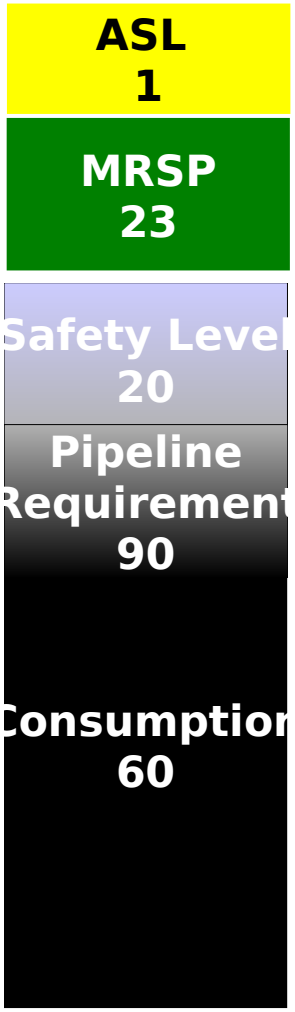


Shopping List

Item (A,B,C...)	Unit cost $	Added end items per $10K	Total cost $	Availability rate %
6th A	1,600	0.388	101,600	66.67
11th B	2,300	0.352	103,900	66.69
2nd C	10,400	0.312	114,300	66.74
12th B	2,300	0.283	116,600	66.76
1st D	13,800	0.154	130,400	66.78
7th A	1,600	0.144	132,000	66.79

AA Targets and Safety Stock



4. MRSP and ASL are additive to the peacetime requirement, and therefore do not directly affect the peacetime AA Target

2. AA Target "sizes" the safety level. Covers the inventory "delta" created by variability in pipeline times and demand.

1. The depot supply system computes initial stock required to fill spares pipelines, i.e., O&ST , retrograde, and repair cycle pipelines.

3. Although the AA Target "sizes" only the safety level, the spares needed to reach the target are the sum of the safety level, pipeline, and consumption (20+90+60=170). Consumption is estimated based on expected demands.

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Computation for Peacetime AA Targets

- **Compute sorties required per day for an average squadron:**

$$\frac{\text{UTE rate} * \text{PAA}}{\text{Flying days per Month}} \qquad \frac{22.0 * 18}{20.78} \qquad = \ 19.06$$

- **Compute sorties to schedule (STS) per day given Ops No-Gos:**

$$\frac{\text{Sorties Required}}{\text{Non-Mx Attrit Factor}} \qquad \frac{19.06}{.885} \qquad = \ 21.53$$

- **Compute # of jets to schedule (JTS) on first go to account for attrition after first flight**

$$\text{1st Go A/C} = \frac{\text{STS}}{\text{2-Attrit}} \qquad = \ \frac{21.53}{2-.175} \qquad = 11.733$$

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Computation for Peacetime AA Targets

- **Add Mx Spares and round up for total 1st go rqmt**

  JTS + Greater of {JTS * Mx attrit factor *or* 1}

  11.73 + {11.73 * .10 *or* 1} = 12.90 >>>>13.000

- **Compute Max # of Jets allowed to be NMC**

  PAA - (JTS + Jets required for MX training)

  18 - (13.0+1.44) = 3.56

- **Compute MC requirement**

$$1 - \frac{\text{NMC Aircraft}}{\text{PAA}} = 1 - \frac{3.56}{18.00} = .8022 >>> 80.22\%$$

- **Compute AA target by accounting for historical NMCM**

  1 - TNMCS = MC requirement + Last years NMCM

  80.22 + 8.75 = **88.97**

Aircraft Engine Component Improvement Program (CIP)

- **PROGRAM DESCRIPTION: Only Air Force R&D Program for Engine Improvements Under IWSM**
- **Provides Only Source of Critical Sustaining Engineering Support for Active Inventory Engines**
- **Develops Solutions to Increase Safety of Flight, Correct Operationally Identified Deficiencies, Improve R&M and Durability, and Reduce Cost of Ownership**
- **CIP Top Priority Is Safety of Flight Issues**
- **CIP Remains Only Source of Critical Sustaining Engineering for Over 22,000 Operational Engines**

Engine Component Improvement Program (CIP) Benefits the Warfighter

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F100 (F-15, F-16) 3rd Disk Blade -- 6 A/C Lost

- Redesigned fan drive turbine disk blade to eliminate blade fractures
- Eliminated borescope inspections every 5 hrs (F-16) & 10 Hrs (F1-5)
- Eliminated driver for 22% of PW-220 unscheduled engine removals
- [illegible] completion

Avoids $114M O&M, Prevents loss of 9 A/C

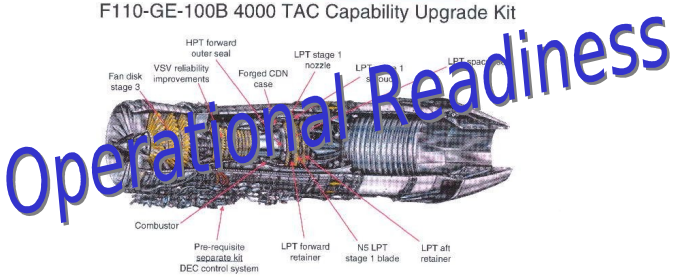
TF-39 (C-5) High Pressure Turbine (HPT) Improvements

- Redesigned highest cost driver on TF39 engine
- Resulting improvements double life of HPT components
- Reduced engine removals & HPT depot overhauls
- 75% of Fleet Modified as of Oct 02

$112.5M Estimated Cost Avoidance Since 1997

F110-100B (F-16) Upgrade

F110-GE-100B 4000 TAC Capability Upgrade Kit

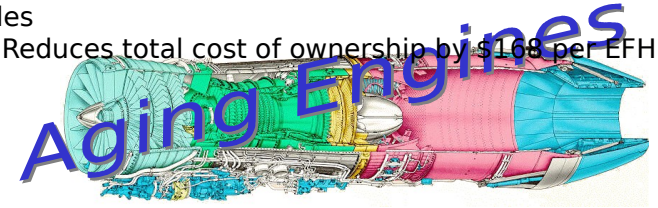


- WRE reduced by 43 engines (152 to 109)
- Unscheduled shop visit rate reduced 30%
- Mx manhours/flight hour reduced 25%

Average Time On Wing Has Doubled

F110 (F-16) Service Life Extension Program

- Extends F110 engine life to meet F-16 Force Structure reqmts
- Eliminates safety inspections, saving 16,326 Mx manhours/year
- Improves reliability--Doubles wartime days without engine holes
- Reduces total cost of ownership by $168 per EFH (21%)



Avoids $1.1B LCC and Prevents Loss of 7 A/C

CIP = Significant Return on Investment

Safety, Readiness, Ownership Cost (21:1 ROI Historical Average)

CIP Requirements versus Funding Level